REMARKS

Claims 1-22, 34, 35, 55, and 56 are rejected under 35 USC §103 as being anticipated by the article by Chin et al.

Independent claim 1 recites a method of forming a semiconductor. The method includes providing a single crystal semiconductor substrate of GaP. The method also includes fabricating a graded composition buffer including a plurality of epitaxial semiconductor $In_x(Al_yGa_{1-y})_{1-x}$.P alloys layers. The buffer comprises a first alloy layer immediately contacting the substrate having a lattice constant that is nearly identical to that of the substrate and a growth temperature greater than 650°C. There are provided subsequent alloy layers having a lattice constant that differ from adjacent layers by less than 1%, and a final alloy layer having a lattice constant this essentially substantially different from the substrate, wherein growth temperature of the final alloy layer is at least 20°C less than the growth temperature of the first alloy layer.

Independent claim 55 recites a semiconductor structure. The semiconductor structure includess a single crystal semiconductor substrate of GaP. A graded composition buffer includes a plurality of epitaxial semiconductor $In_x(Al_yGa_{1-y})_{1-x}$.P alloys layers where y is greater than zero. The buffer comprises a first alloy layer immediately contacting the substrate having a lattice constant that is nearly identical to that of the substrate and a growth temperature greater than 650°C. There are provided subsequent alloy layers having a lattice constant that differ from adjacent layers by less than 1%, and a final alloy layer having a lattice constant this

essentially substantially different from the substrate, wherein growth temperature of the final alloy layer is at least 20°C less than the growth temperature of the first alloy layer.

Independent claim 56 recites a method of forming a semiconductor. The method includes providing a single crystal semiconductor substrate of GaP. The method also includes fabricating a graded composition buffer including a plurality of epitaxial semiconductor $In_x(Al_yGa_{1-y})_{1-x}$.P alloys layers. The buffer comprises a first alloy layer immediately contacting the substrate having a lattice constant that is nearly identical to that of the substrate. There are provided subsequent alloy layers having a lattice constant that differ from adjacent layers by less than 1%, and a final alloy layer having a lattice constant this essentially substantially different from the substrate, wherein growth temperature of the final alloy layer is at least 20°C less than the growth temperature of the first alloy layer.

Chin et al. describe highly mismatched In_xGa_{1-x}.P ($x \leq 0.38$) layers grown on GaP substrates by gas-source molecular beam epitaxy. A relatively thin, compositionally linear-graded buffer layer is used to reduce the number of threading dislocations.

Amended independent claims 1, 55, and 56 recite a graded composition buffer including a plurality of epitaxial semiconductor $In_x(Al_yGa_{1-y})_{1-x}$.P alloys layers. Secondly, claims 1, 55, and 56 recite those subsequent alloy layers of the buffer having a lattice constant that differs from adjacent layers by less than 1%. Chin et al. specifically recite that their growth temperature is less than 650 °C. In particular, Chin et al. describe forming a GaP substrate at 650 °C on a Si substrate followed by a graded $In_xGa_{1-x}P$ buffer.

Note Chin et al. grow $In_xGa_{1-x}P$ mismatched layers on GaP substrates. However, claims 1, 55 and 56 recite a graded composition buffer including a plurality of epitaxial semiconductor $In_x(Al_yGa_{1-y})_{1-x}P$ alloy layers, where y is greater than zero. That is different given that the $In_xGa_{1-x}P$ is not exactly the same as the recited graded composition buffer and the technique described in Chin et al. is an alternative approach in forming a direct-gap InGaAlP structure. Thus, Chin et al. does not render obvious claims 1, 55, and 56, respectively.

As to claims 2-22 and 34-35, they are dependent on claim 1, respectively. Therefore, claims 2-22 and 34-35 are also allowable for the same reasons argued with respect to claim 1.

Claims 3-33 are rejected under 35 USC §103 as being obvious over Chin et al.

Given that claims 3-22 are dependent on claim 1, the reasons argued with respect to claim 1 are also applicable here. Furthermore, the Examiner asserts that routine experimentation using the techniques described in Chin et al. could be used to obtain results recited in claims 3-22. As stated above, Chin et al. use a very different technique to form buffers, which limits its ability to use growth temperatures beyond 650°C. A person of skill in the art would require undue experimentation to try to reach the growth temperatures recited in claims 3-22. Therefore, it is requested that the Examiner reconsider his position on claims 3-22.

Claims 23-29 and 36-39 are rejected under 35 USC §103 as being obvious in view of Chin et al. and Chen et al., US 6,064,076.

Chen et al. '076 describes a light-emitting diode having a transparent GaP substrate that includes a first lattice constant, a first ohmic contact to the GaP substrate, a buffer layer having

a graded lattice constant which gradually changes from a first lattice constant to a second lattice constant, a light generating region formed on the buffer layer and having the second lattice constant, and a second ohmic contact formed on the light generating region. Light emitted to the substrate is not absorbed by the transparent substrate.

Given that claims 23-29 and 36-39 are dependent on claim 1, the reasons argued with respect to claim 1 are also applicable here. Also, Chen et al. '076 does not address the deficiencies of Chin et al. Moreover, claim 1 recites that the subsequent alloy layers of the buffer having a lattice constant that differ from adjacent layers *by less than 1%*. Chen et al. '076 *is silent* on this issue. Therefore, the proposed combination of Chin et al. and Chen et al. '076 does not render obvious claims 23-29 and 36-39.

Claims 30-33 and 40-52 are rejected under 35 USC §103 as being obvious in view of Chin et al. and Chen et al., US 6,064,076.

Given that claims 30-33 and 40-52 are dependent on claim 1, the reasons argued with respect to claim 1 are also applicable here. Also, Chen et al. '076 does not address the deficiencies of Chin et al. Furthermore, the Examiner asserts that routine experimentation using the techniques described in Chin et al. could be used to obtain results recited in claims 30-33 and 40-52. As stated above, Chin et al. uses a very different technique to form it buffers, which limits its ability to use growth temperatures beyond 650°C. Therefore, the proposed combination of Chin et al. and Chen et al. '076 does not render obvious claims 23-29 and 36-39.

In view of the above amendments and for all the reasons set forth above, the Examiner is respectfully requested to reconsider and withdraw the rejections made under 35 U.S.C. §§ 103. Accordingly, an early indication of allowability is earnestly solicited.

If the Examiner has any questions regarding matters pending in this application, please feel free to contact the undersigned below.

Respectfully submitted,

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